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MARKSCHEME

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INFORMATION TECHNOLOGY IN A GLOBAL SOCIETY

Higher Level

Paper 2

16 pages

Examiners should be aware that in some cases, candidates may take a different approach, which if appropriate should be rewarded. If in doubt check with your Team Leader.

In the case of an "identify" question read all answers and mark positively up to the maximum marks. Disregard incorrect answers. In the case of a "describe" question, which asks for a certain number of facts *e.g.* "describe two kinds", mark the **first two** correct answers. This could include two descriptions, one description and one identification, or two identifications.

"ITGS terminology refers to both the IT technical terminology and to the terminology related to social and ethical impacts."

Area of impact: Science and the environment / Health

1. (a) Define the term *relational database*. ***[2 marks]***

- collection of data items organized in tables
- key fields are used to link data between the tables
- organization of data in tables reduces data redundancy
- changes in one table are reflected in other tables automatically.

*Award **[1 mark]** for any of the above points up to a maximum of **[2 marks]**.*

(b) Describe the process of how a particular person's DNA could be checked against data in the national DNA database to see if their DNA data has been stored. ***[4 marks]***

- DNA sample is collected from the evidence found from the crime being investigated/person submits DNA sample
- DNA data is converted into digital code
- a program is used that compares the DNA digital code to the DNA codes that have been collected and stored in a database from persons committing previous crimes
- when a match is found, the name of the criminal suspect is retrieved from the database/the person is identified as a suspect in the database.

*Award **[1 mark]** for each of the steps up to a maximum of **[4 marks]**.*

(c) Explain *two* security measures that would need to be implemented by a government before a national DNA database can be introduced. ***[4 marks]***

Security measure and reason:

- levels access for different users of the database
- use of passwords/biometrics need to be implemented for secure access
- exporting data from the database has been blocked to prevent misuse
- virus checking software has been implemented on the server so that the database is not corrupted
- firewall has been set up, blocking unauthorized access
- laws regarding access, use and/or storage of the DNA database to ensure proper use
- encryption of DNA data – encryption of data on central database so hackers who gain access cannot read the data without being able to decode it
- encryption of data during transfer – in order to protect data from unauthorized access when it is sent to the central database
- backing up data so records are not lost – a backup routine needs to be instigated/backups need to be stored off site
- physical security of hardware – *e.g.* locked room with keycards/biometric identification to enter.

*Award **[1 mark]** for each security measure identified. Award an additional **[1 mark]** for the development of that measure up to a maximum of **[2 marks]**. Mark the first two correct security measures identified.*

(d) Evaluate the possible impacts on UK citizens of collecting DNA data from children at birth. ***[10 marks]***

Positive and negative impacts of the following may be evaluated:

Negative impacts

- the DNA database may be shared with other government agencies for purposes that are different from the original intention
- if data is leaked then health insurance companies could deny insurance cover
- if data is not secure then unauthorized access could lead to blackmail/identity theft/loss of data integrity
- UK citizens could be falsely accused of a crime because a small DNA sample is found from the person at the scene of a crime/due to errors entering personal information
- invasion of privacy impacts because the DNA database could reveal additional information (*e.g.* health risks, race, potential psychiatric disorders, paternity) – some people do not want to know if they are susceptible to diseases
- possible to assemble biometric profiles of UK residents
- police will have more information about offenders than ever before (e.g. DNA could be traced and family relatives could be unfairly targeted by police)
- DNA database could be used in data matching with other government databases.
- there will be costs involved and these could be offset by taxes to UK citizens.

Positive impacts

- early detection of diseases could lead to a cure
- DNA database could reveal additional information and this may help medical research into disease prevention
- if the tissue samples are also stored, the human cells could be re-tested in the future for more information as DNA analysis becomes more advanced
- DNA matching could help crime prevention/identify bodies in a disaster.

In part (d) of this question it is acceptable if there is more emphasis on the ITGS terminology related to social and ethical impacts and less on IT technical terminology.

Please see generic markband information sheet on page 16.

Area of impact: Business and employment

2. (a) For the following URL:
http://www.richmondtaylor.co.uk/images/photo27.jpg

(i) identify the domain name ***[1 mark]***

www.richmondtaylor.co.uk or richmondtaylor.co.uk

N.B. Answer must NOT contain http:// or any other part of the URL.

*Award **[1 mark]** for the correct response.*

(ii) identify the file name. ***[1 mark]***

photo27.jpg or photo27

*Award **[1 mark]** for the correct response.*

(b) (i) Describe *one* way a new company can register a new domain name. ***[2 marks]***

- register with an accredited domain name/Internet registrar/purchase a domain name through an official site – check the domain name is free/pay an annual subscription (accept also: "register with the domain name server")
- contact your web-hosting company *ISP* who has a relationship with a particular registrar that allows you to purchase your web-hosting account and domain name with one transaction
- select a domain name on a web site that is already registered (*e.g.* wikispaces) but the web site name may be a part of the domain name
- purchase a domain name – this could be done via an online trading place/auction and is necessary if the desired name is already in use.

*Award **[1 mark]** for only identifying one way a company can register a new domain name.*
*Award up to a maximum of **[2 marks]** for a description of one way a company can register a new domain name.*

(ii) Describe why a company would prefer to use a domain name for its web site rather than an IP address. ***[2 marks]***

- easy to remember – for example users would have to remember the numbers which have no special meaning to them but a company name *e.g. ToysRus* will be easy to relate to the company
- easy to type – for example a set of numbers is easy to mistype but a name can have meaning so errors are less likely
- domain names can give users some information about the site they will be visiting – this information can help attract customers/an IP address says nothing about the content of the site they will be visiting.

*Award **[1 mark]** for identifying a reason why a company would prefer to use a domain than an IP address.*
*Award up to a maximum of **[2 marks]** for a description of the reason.*

(c) Explain *two* technical issues that must be addressed to enable a company to introduce teleworking for its employees. ***[4 marks]***

Technical issues may include providing:

- Remote access for the employee to company servers – *e.g.* VPN provides secure access enabling employees to safely share/access files.
- Software and communications services for the employee in order for them to be able to telework. Software may include electronic mail, FTP, fax, Internet browser, encryption, remote access, video conference, Internet phone and possible own data transfer software in addition to applications used in the company.
- Hardware for employees to use outside the office – *e.g.* laptop to access the office from any place/web cam, microphone, speakers to enable collaboration.
- Online technical support for employees – may use remote access software to resolve help desk queries/phone help desk support.
- Services for maintenance and repair for employees – replacement computers/onsite visit to employee's home.
- Software licences for use by employees who are teleworking – additional licences will need to be purchased for home computers or a site licence that extends to workers at home.
- Training for the employee in order to be able to use IT systems for teleworking – this could include a workshop on using the web cam, microphone, setting up the VPN.
- Security measures for both the company and teleworkers' IT systems (*i.e.* backup, virus checkers, encryption) – *e.g.* a company could use a VPN to provide security for data during transmission.
- Authentication – *e.g.* logins and passwords.
- Ensuring compatibility of software between home and office – *e.g.* same versions of the word processor so files from the company server can be downloaded and edited.
- Ensuring workers have appropriate Internet access from home (secure connection, appropriate bandwidth, spyware checks).

*Award **[1 mark]** for each technical issue identified. Award an additional **[1 mark]** for the explanation of that technical issue up to a maximum of **[2 marks]**. Mark the first two correct technical issues identified.*

(d) To what extent has the change to teleworking been beneficial to both employers and employees? ***[10 marks]***

Benefits for employers

- cost savings (*i.e.* premises costs, office overheads and reduced recruitment costs)
- increased productivity (*i.e.* teleworkers avoid travel time, none of the interruptions of an office environment) – but cannot monitor employees to see if they are working
- improved motivation for employees – but loss of motivation generated in a workplace environment
- employees who might otherwise leave can remain in their jobs
- employees on maternity leave can continue to work and require less re-training when they return to work
- organization flexibility (*i.e.* teams representing the best skills and experience for a particular project can be created, regardless of geography and time differences; part-time workers can be on stand-by when more work is available)
- no disruption in the event of problems (*i.e.* transport strikes, severe weather, natural disasters)
- enhanced customer service extended beyond the working day or the working week without the costs of overtime payments or the need for staff to work (and travel) at unsocial hours – but this could negatively affect employees who cannot get away from work
- may have access to wider diversity of employees as the company can hire from around the world.

Benefits for employees

- reduced travel time and costs – but cost to set up hardware if employer doesn't pay for a home system
- improved work opportunities (*i.e.* job not confined to a specific commuting distance)
- less disruption to family life (*i.e.* no need to move due to job change)
- better balance of work and family life (*i.e.* be with the family and participate in home responsibilities such as transporting children, shopping) – but may be hard to separate work and home
- participation in the local community (*i.e.* be involved in local clubs at a time when commuters are still *en route*) – but less interaction with work colleagues
- flexible hours (*i.e.* individual freedom to stop and start work according to what is best) – but home distractions may interfere with work.

In part (d) of this question it is acceptable if there is more emphasis on the ITGS terminology related to social and ethical impacts and less on IT technical terminology.

Please see generic markband information sheet on page 16.

Area of impact: Education / Politics and government

3. (a) Define the term *simulation*. ***[2 marks]***

- model a real-life or hypothetical situation on a computer
- used to demonstrate the alternative effects of varied conditions
- by changing variables, predictions may be made
- uses a set of mathematical formulae.

N.B. The second mark may be awarded for an example of a simulation.

*Award **[1 mark]** for any of the above points up to a maximum of **[2 marks]**.*

(b) Describe *two* differences between artificial intelligence and expert systems. ***[4 marks]***

- Expert systems are a subset of artificial intelligence (AI). Expert systems are only rule-based systems, AI uses a wide range of methods such as categorization, rule-based systems, heuristics, past experience, expectations.
- Expert systems are intended to use the knowledge and experience of experts and make it behaviour that may or may not have actually occurred
- Expert systems use a knowledge base derived from experts whereas AI solves problems mimicking human thought processes.
- AI takes small quantities of input and creates large quantities of output, an expert system does just the opposite and takes a large amount of data (input) and through analysis produces a small amount of information (output) (*i.e.* a decision or recommendation for the user).
- Expert systems do not learn from their mistakes – new knowledge must be input. AI involves learning.

*Award **[1 mark]** for each difference identified. Award an additional **[1 mark]** for the development of that difference up to a maximum of **[2 marks]**. Mark the first two correct differences identified.*

(c) Explain why artificial intelligence is used in the construction of digital game-based learning. ***[4 marks]***

- learn the game play of the player
- modify the experience of the player according to past performance
- provides environments that are more oriented towards the learning of the end-user (*i.e.* more engaging, motivating, challenging and interesting)
- can utilize role play and narrative forms to envision events from history or possible scenarios from the future.

[1 mark]
A limited response that indicates very little understanding of the topic or the reason is not clear.

[2–3 marks]
A reasonable description of why artificial intelligence is used in the construction of digital game-based learning, although the answer may be unbalanced and lack appropriate reasoning at the lower end of the band.

[4 marks]
A clear, detailed and balanced explanation of why artificial intelligence is used in the construction of digital game-based learning.

(d) Evaluate the role of digital game-based learning and simulation in the training of soldiers. ***[10 marks]***

Negatives

- soldiers become desensitized to serious situations in the real world (*i.e.* potential danger, deaths)
- the game used for training may not closely align with the real situation that the soldier faces – it only approximates reality
- soldiers cannot make the transfer of the training in the game-based learning situation to the real situation
- cost of hardware (processing power, graphics cards), software
- security – if hackers gain access they may learn military strategies
- creates a digital divide – countries with access to these resources are advantaged in wars.

Positives

- reduced cost spent on training of soldiers – *e.g.* setting up locations, travel, training
- soldiers compete against state-of-the-art computer artificial intelligence – can modify the game according to user performance and provide challenges
- allows soldiers to play the role of various stakeholders (*e.g.* Joint Force Commander)
- adjust scenarios to test varying military possibilities
- photorealistic terrain maps of actual combat regions
- allows soldiers to train using the most modern 3D military units/team work is possible
- game-based learning is motivating because of the game format (*i.e.* high-resolution and high-detailed graphics, dynamic 3D battle effects)
- soldiers learn from mistakes – in a safe environment and their lives are not at risk
- characters may die, but this is not permanent
- feedback can be provided on user performance.

In part (d) of this question it is acceptable if there is more emphasis on the ITGS terminology related to social and ethical impacts and less on IT technical terminology.

Please see generic markband information sheet on page 16.

Area of impact: Arts, entertainment and leisure

4. (a) Identify *two* kinds of information that are stored in an online video broadcasting database about each of the videos. ***[2 marks]***

- online name of the person/personal details of the person who uploaded the video
- date the video was uploaded
- name of the video
- URL of the video
- embedded code for the video
- description for the video
- tags for the video
- length/duration of the video
- video format (mp4, flv, *etc.*)
- if there is an age restriction *i.e.* over 18
- file size.

*Award **[1 mark]** for each appropriate kind of information identified up to a maximum of **[2 marks]**.*

(b) Describe *two* reasons why there is a requirement to use a captcha when setting up an account. ***[4 marks]***

- demonstrate that a human is entering the information – because machines cannot read the graphic
- avoid automated systems for completing the forms with bogus information, which could lead to abuse of the service
- stop automated postings to blogs, forums and wikis, whether as a result of commercial promotion, harassment or vandalism
- captcha – can be deployed to protect systems vulnerable to e-mail spam, such as the web mail services
- protect e-mail addresses from spammers who crawl the World Wide Web in search of e-mail addresses posted in clear text – require users to solve a CAPTCHA before showing their e-mail address.

*Award **[1 mark]** for each reason identified. Award an additional **[1 mark]** for the development of that reason up to a maximum of **[2 marks]**. Mark the first two correct reasons identified.*

(c) Explain *two* ways video services such as *YouTube* can ensure that the videos uploaded by members comply with copyright laws. ***[4 marks]***

- users must agree to online policies indicating copyright must be observed
- explanation is provided online about what is copyrighted on its web site
- the company could manually check all the videos that have been uploaded/random checks could be made on uploaded videos – videos are made available after checking
- automatically check uploaded videos against a database of copyrighted videos
- videos violating copyright are removed from the online video broadcasting service – offenders are removed as members
- complaints from customers are followed up by the online video broadcasting service.

*Award **[1 mark]** for identifying how videos uploaded can comply with copyright laws. Award an additional **[1 mark]** for the development of the initial point up to **[2 marks]**. Mark the first two correct ways identified.*

(d) To what extent have web sites such as *YouTube* been used for more purposes than leisure and entertainment? ***[10 marks]***

- amateurs posting videos of current news happenings to online video broadcasting services
- software companies and trainers posting training videos to online video broadcasting services
- political speeches for campaigning for elections
- educational lectures (*e.g.* what is web 2.0, physics) – a source of free resources for under-resourced schools/there is an ability to post questions
- demonstration of how to perform a particular task (*e.g.* particular technique in photography, how to set up a wireless network)
- presentation of new IT technology (*e.g.* particular hardware/software)
- terrorism – used as advertising, used to "indoctrinate", used to teach how to create bombs
- many news channels post videos of news on these services and allow users worldwide access to latest news
- health campaigns for disease prevention/health care
- individuals posting their CV to attract employers who may offer them a job
- businesses marketing products – *e.g.* clothing manufacturers preparing a video of new products/musical groups uploading video clips of latest songs to promote a CD.

Some negatives that may be considered in analysis of non-leisure use:

- videos used in education and training need to be used with caution as anybody can post a video and the content may not be accurate
- news stories should be checked for accuracy
- individuals posting personal information (*e.g.* CV) should be aware of privacy issues – who is downloading their personal details?
- political speeches should be checked as many fake videos have been posted to discredit politicians
- bandwidth could be a limitation *e.g.* for educational use
- limitations on size of upload – users compress videos which could impact on quality and information *e.g.* in medical training.

In part (d) of this question it is expected that there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to the social and ethical impacts.

Please see generic markband information sheet on page 16.

Markband for all extended response questions

Opinion discuss, evaluate, justify, recommend and to what extent	***0***	*No knowledge or understanding of IT issues and concepts or use of ITGS terminology.*
	1–2 marks	*A brief and generalized response with very little knowledge and understanding of IT issues and concepts with very little use of ITGS terminology.*
	3–5 marks	*A response that may include opinions, conclusions and/or judgments that are no more than unsubstantiated statements.* *The response will largely take the form of a description with a limited use of ITGS terminology and some knowledge and/or understanding of IT issues and/or concepts.* *If no reference is made to the information in the stimulus material, award up to* ***[3 marks]****.* *At the top end of this band the description is sustained.* *At the lower end of the band a tendency towards fragmentary, common sense points with very little use of ITGS terminology.*
	6–8 marks	*A response that demonstrates opinions, conclusions and/or judgments that have limited support.* *The response is a competent analysis that uses ITGS terminology appropriately. If there is no reference to ITGS terminology the candidate cannot access this markband.* *There is evidence that the response is linked to the information in the stimulus material.* *At the top end of the band the response is balanced, the response is explicitly linked to the information in the stimulus material and there may be an attempt to evaluate it in the form of largely unsubstantiated comments. There is also evidence of clear and coherent connections between the IT issues.* *At the lower end of the band the response may lack depth, be unbalanced or tend to be descriptive. There may be also implicit links to the information in the stimulus.*
	9–10 marks	*A detailed and balanced (at least one argument in favour and one against) response that demonstrates opinions, conclusions and/or judgments that are well supported and a clear understanding of the way IT facts and ideas are related.* *Thorough knowledge and understanding of IT issues and concepts.* *Appropriate use of ITGS terminology and application to specific situations throughout the response.* ***If there is no reference to ITGS terminology candidates cannot access this markband.*** *The response is explicitly linked to the information in the stimulus material.* *At the lower end of the band opinions, conclusions and/or judgment may be tentative.*

"ITGS terminology refers to both the IT technical terminology and to the terminology related to social and ethical impacts."